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National Eutrophication Survey, Corvallis, Oreg

Prepared for

Corvallis Environmental Research Lab, Oreg

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NATIONAL EUTROPHICATION SURVEY

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
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REPORT

ON

DEVILS LAKE

BENSON AND RAMSEY COUNTIES

NORTH DAKOTA

EPA REGION VIII

WORKING PAPER No. 569

WITH THE COOPERATION OF THE

NORTH DAKOTA STATE DEPARTMENT OF HEALTH

AND THE

NORTH DAKOTA NATIONAL GUARD

SEPTEMBER, 1976

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F O R E W O R D

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to freshwater lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's freshwater lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the North Dakota State Department of Health for professional involvement, to the North Dakota National Guard for conducting the tributary sampling phase of the Survey, and to those North Dakota wastewater treatment plant operators who voluntarily provided effluent samples and flow data.

Norman L. Peterson, Director, and the staff of the Division of Water Supply and Pollution Control of the Department of Health, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

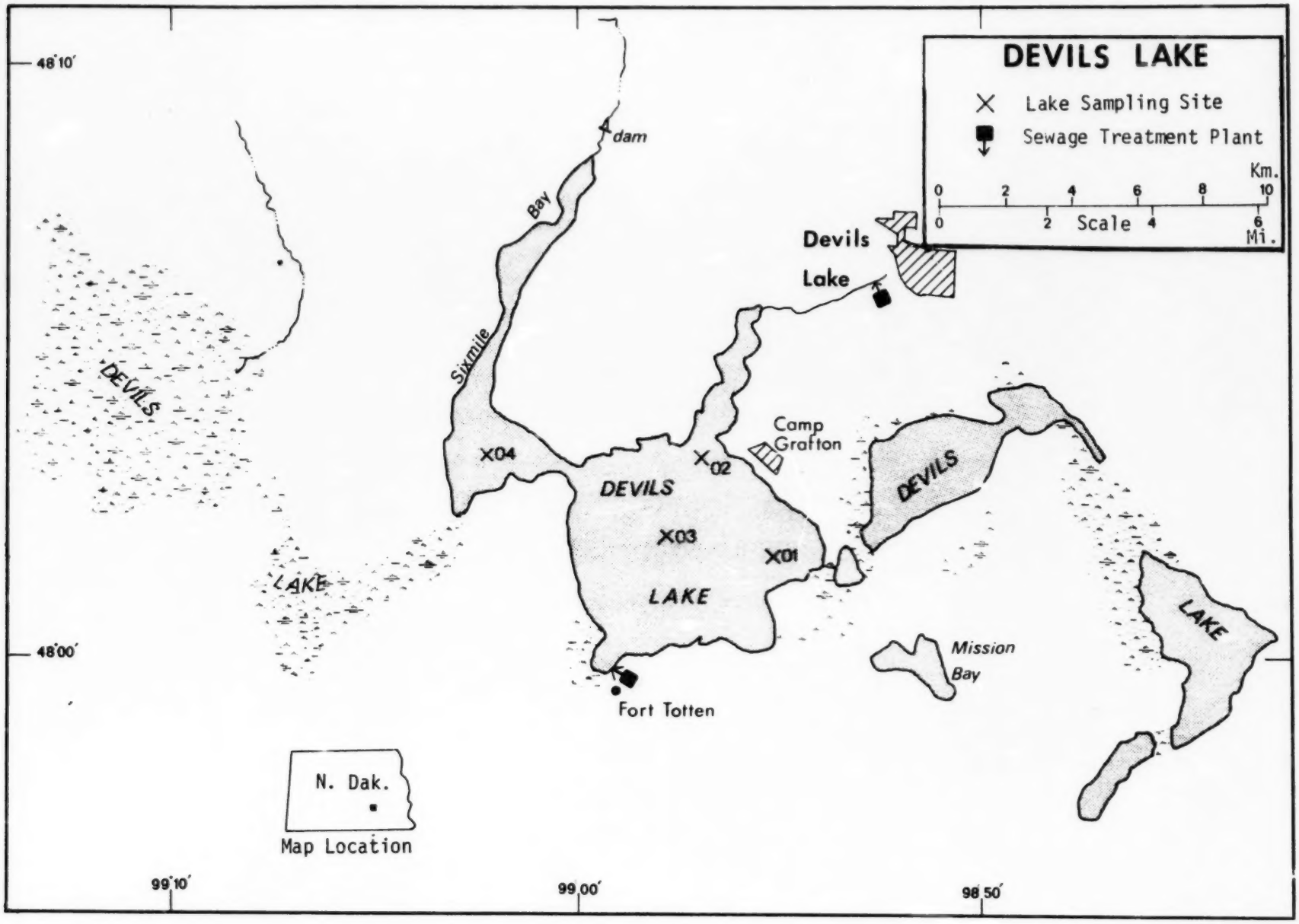
Major General LaClair A. Melhouse, the Adjutant General of North Dakota, and Project Officer Colonel Irvin M. Sande, who directed the volunteer efforts of the North Dakota National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES AND RESERVOIRS

STATE OF NORTH DAKOTA

NAME	COUNTY
Ashtabula	Barnes, Griggs
Audubon	McLean
Brush	McLean
Darling	Renville, Ward
Devils	Benson, Ramsey
Jamestown	Stutsman
LaMoure	LaMoure
Matejcek	Walsh
Metigoshe	Bottineau
Pelican	Bottineau
Sakakawea	Dunn, McKenzie, McLean, Mercer, Mountrail, Williams
Spiritwood	Stutsman
Sweet Briar	Morton
Whitman	Nelson, Walsh


DEVILS LAKE
Lake Sampling Site
Sewage Treatment Plant
Km.
0 2 4 6 8 10
0 2 Scale 4 6 Mi.
48°10'
48°00'
99°10'
99°00'
98°50'
dam
Bay
Sixmile
Devils
Lake
DEVILS
LAKE
X04
X02
X03
X01
DEVILS
LAKE
Camp
Grafton
DEVILS
LAKE
Mission
Bay
Fort Totten
N. Dak.
Map Location

DEVILS LAKE

STORET NO. 3805

I. INTRODUCTION

Devils Lake was included in the National Eutrophication Survey as a water body of interest to the North Dakota Department of Health. Tributaries and nutrient sources were not sampled, and this report relates only to the lake sampling data.

Devils Lake is in a closed basin, is relatively shallow, and generally remains thoroughly-mixed and well-oxygenated during ice-free months. Thermal stratification is temporary and is readily disrupted by wind which has an average annual velocity of 16 km/hr.

Devils Lake has a high concentration of total dissolved salts (14,000-18,000 mg/l) as well as high organic nitrogen and phosphorus resulting from sewage effluents and agricultural drainage into the lake (Armstrong, Anderson, and Callender, 1966).

II. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Devils Lake is eutrophic. It ranked thirteenth in overall trophic quality when the 14 North Dakota lakes sampled in 1974 were compared using a combination of six parameters*. All of the other lakes had less median total and dissolved phosphorus, four had less median inorganic nitrogen, ten had less mean chlorophyll a, and nine had greater mean Secchi disc transparency.

Survey limnologists noted large blooms of filamentous algae

* See Appendix A.

as well as submerged and emergent macrophytes at all stations.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Devils Lake was nitrogen limited at the time the sample was collected (09/16/74). The lake data indicate nitrogen limitation at all sampling times.

III. LAKE CHARACTERISTICS†

A. Lake Morphometry††:

1. Surface area: 48.00 kilometers^2.
2. Mean depth: 2.6 meters.
3. Maximum depth: 9.1 meters*.
4. Volume: 124.800 x 10^6 m^3.

B. Precipitation**:

1. Year of sampling: 35.0 centimeters.
2. Mean annual: 30.0 centimeters.

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† Table of metric equivalents--Appendix B.
†† Armstrong, Anderson, and Callender, 1966.
* Henegar, 1975.
** See Working Paper No. 175, "...Survey Methods, 1970-76".

IV. LAKE WATER QUALITY SUMMARY

Devils Lake was sampled three times during the open-water season of 1974 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from four stations on the lake and from two or more depths at each station (see map, page v). During each visit, a single depth-integrated (4.6 m or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the third visit, a single 18.9-liter depth-integrated sample was composited for algal assays. Also each time, a depth-integrated sample was collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 5.8 meters at stations 1 and 2, 6.1 meters at station 3, and 3.0 meters at station 4.

The sampling results are presented in full in Appendix C and are summarized in the following table.

A. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR DEVILS LAKE
STORET CODE 3805

PARAMETER	1ST SAMPLING (4/29/74) 4 SITES RANGE	MEAN	MEDIAN	2ND SAMPLING (7/16/74) 4 SITES RANGE	MEAN	MEDIAN	3RD SAMPLING (9/16/74) 4 SITES RANGE	MEAN	MEDIAN
TEMP (C)	2.8 - 7.5	4.6	4.3	22.4 - 23.7	23.3	23.3	12.8 - 14.9	13.5	13.4
DISS OXY (MG/L)	0.4 - 10.8	6.4	7.6	5.4 - 7.0	6.3	6.4	7.4 - 12.6	8.9	8.7
CNDCTVY (MCROMO)	2530. - 4440.	3646.	3637.	3115. - 5040.	4632.	4959.	2758. - 3743.	3539.	3672.
PH (STAND UNITS)	8.4 - 8.6	8.6	8.6	8.6 - 8.9	8.8	8.8	8.8 - 9.1	8.9	8.9
TOT ALK (MG/L)	288. - 610.	420.	420.	290. - 460.	390.	398.	465. - 635.	548.	535.
TOT P (MG/L)	0.434 - 1.560	0.890	0.845	0.536 - 0.788	0.648	0.652	0.360 - 0.770	0.475	0.461
ORTHO P (MG/L)	0.355 - 0.924	0.713	0.765	0.333 - 0.568	0.461	0.474	0.191 - 0.340	0.301	0.320
NO2+NO3 (MG/L)	0.320 - 0.620	0.462	0.480	0.030 - 0.070	0.059	0.060	0.020 - 0.080	0.035	0.025
AMMONIA (MG/L)	0.050 - 0.320	0.139	0.090	0.050 - 0.100	0.073	0.070	0.040 - 0.150	0.069	0.060
KJEL N (MG/L)	1.800 - 3.600	2.855	2.700	2.200 - 3.200	2.527	2.400	2.800 - 5.100	3.375	3.200
INORG N (MG/L)	0.370 - 0.800	0.601	0.590	0.110 - 0.160	0.132	0.130	0.060 - 0.230	0.104	0.090
TOTAL N (MG/L)	2.160 - 4.080	3.316	3.200	2.270 - 3.260	2.586	2.460	2.820 - 5.120	3.410	3.235
CHLRPYL A (UG/L)	3.6 - 21.6	8.7	4.8	2.7 - 109.0	42.2	28.5	49.0 - 89.4	64.6	60.1
SECCHI (METERS)	0.9 - 2.3	1.7	1.8	0.9 - 2.1	1.7	1.8	0.3 - 0.6	0.5	0.6

B. Biological characteristics:

1. Phytoplankton -

Sampling Date	Dominant Genera	Algal Units per ml
04/29/74	1. Flagellates	1,004
	2. Dactlyococcopsis sp.	521
	3. Chlorophytan lunate cells	409
	4. Chroomonas sp.	186
	5. Cryptomonas sp.	112
	Other genera	446
	Total	2,678
07/16/74	1. Stephanodiscus sp.	748
	2. Aphanizomenon sp.	721
	3. Microcystis sp.	480
	4. Phormidium sp.	27
	5. Schroederia sp.	27
	Other genera	81
	Total	2,084
09/16/74	1. Aphanizomenon sp.	6,330
	2. Microcystis sp.	245
	3. Schroederia sp.	70
	4. Oocystis sp.	35
	5. Stephanodiscus sp.	35
	Other genera	-
	Total	6,715

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
04/29/74	1	5.7
	2	3.9
	3	3.6
	4	21.6
07/16/74	1	2.7
	2	30.5
	3	26.5
	4	109.0
09/16/74	1	89.4
	2	49.0
	3	67.3
	4	52.9

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)
Control	0.330	0.545	15.3
0.050 P	0.380	0.545	16.2
0.050 P + 1.0 N	0.380	1.545	42.1
1.0 N	0.330	1.545	37.9

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Devils Lake was high at the time the sample was collected (09/16/74). The lack of an increase in yield with increased orthophosphorus until nitrogen was also added and the significant increase in yield when nitrogen alone was added indicate nitrogen limitation.

The lake data indicate nitrogen limitation at all sampling times; i.e., the mean inorganic nitrogen/orthophosphorus ratios were less than 1/1 at all sampling times, and nitrogen limitation would be expected.

Nitrogen limitation, as indicated by the algal assay or by in-lake nitrogen to phosphorus ratios, does not necessarily mean that the trophic condition of the lake can be improved by controlling nitrogen inputs. In many cases, the apparent condition of nitrogen-limitation results from excessive phosphorus input from point sources and is often accompanied by a corresponding increase in primary production. In such cases, the reversal of the enriched condition depends upon phosphorus control, not nitrogen control.

V. LITERATURE REVIEWED

Armstrong, Richard, David W. Anderson, and Edward Callender, 1966. Primary productivity measurements at Devils Lake, North Dakota. Proc. ND Acad. Sci., vol 20, pp. 136-149.

Henegar, Dale, 1975. Personal communication (lake morphometry). ND Game & Fish Dept., Bismarck.

Shubert, L. Elliot, 1976. The algal growth potential of Devils Lake, North Dakota, 1974-1975. Dept. Biol., U. of ND (U.S. Bur. Reclam. Research Contract 14-06-600-959A).

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P
3801	LAKE ASHTABULA	0.260	0.160	472.250	40.892	10.600	0.170
3802	LAKE AUDUBON	0.087	0.220	446.222	11.322	11.000	0.015
3803	BRUSH LAKE	0.066	0.095	449.143	29.114	9.000	0.010
3804	LAKE DARLING	0.274	0.250	466.750	60.075	11.600	0.180
3805	DEVILS LAKE	0.630	0.140	449.333	38.508	14.600	0.469
3806	JAMESTOWN RESERVOIR	0.144	0.365	438.667	19.400	8.800	0.078
3807	LAKE LA MOURE	0.438	0.380	421.400	19.720	15.000	0.290
3808	MATEJCEK LAKE	0.228	0.440	475.167	2.683	14.400	0.179
3809	LAKE METIGOSHE	0.032	0.080	389.167	10.367	9.000	0.010
3811	PELICAN LAKE	0.034	0.070	364.500	10.950	12.800	0.006
3812	LAKE SAKAKAWEA (GARRISON	0.016	0.150	408.733	6.883	10.800	0.007
3813	SPIRIT WOOD LAKE	0.156	0.290	417.833	34.667	15.000	0.082
3814	SWEET BRIAR RESERVOIR	0.092	0.090	440.800	39.000	8.800	0.031
3815	WHITMAN LAKE	0.260	0.260	478.333	27.067	9.200	0.185

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS ORTHO P	INDEX NO
3801	LAKE ASHTABULA	27 (3)	54 (7)	15 (2)	8 (1)	62 (8)	38 (5)	204
3802	LAKE AUDUBON	69 (9)	46 (6)	46 (6)	69 (9)	46 (6)	69 (9)	345
3803	BRUSH LAKE	77 (10)	77 (10)	38 (5)	38 (5)	81 (10)	81 (10)	392
3804	LAKE DARLING	15 (2)	38 (5)	23 (3)	0 (0)	38 (5)	23 (3)	137
3805	DEVILS LAKE	0 (0)	69 (9)	31 (4)	23 (3)	15 (2)	0 (0)	138
3806	JAMESTOWN RESERVOIR	54 (7)	15 (2)	62 (8)	62 (8)	96 (12)	54 (7)	343
3807	LAKE LA MOURE	8 (1)	8 (1)	69 (9)	54 (7)	4 (0)	8 (1)	151
3808	MATEJCEK LAKE	38 (5)	0 (0)	8 (1)	100 (13)	23 (3)	31 (4)	200
3809	LAKE METIGOSHE	92 (12)	92 (12)	92 (12)	85 (11)	81 (10)	81 (10)	523
3811	PELICAN LAKE	85 (11)	100 (13)	100 (13)	77 (10)	31 (4)	100 (13)	493
3812	LAKE SAKAKAWEA (GARRISON	100 (13)	62 (8)	85 (11)	92 (12)	54 (7)	92 (12)	485
3813	SPIRIT WOOD LAKE	46 (6)	23 (3)	77 (10)	31 (4)	4 (0)	46 (6)	227
3814	SWEET BRIAR RESERVOIR	62 (8)	85 (11)	54 (7)	15 (2)	96 (12)	62 (8)	374
3815	WHITMAN LAKE	27 (3)	31 (4)	0 (0)	46 (6)	69 (9)	15 (2)	188

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	3809	LAKE METIGOSHE	523
2	3811	PELICAN LAKE	493
3	3812	LAKE SAKAKAWEA (GARRISON	485
4	3803	BRUSH LAKE	392
5	3814	SWEET BRIAR RESERVOIR	374
6	3802	LAKE AUDUBON	345
7	3806	JAMESTOWN RESERVOIR	343
8	3813	SPIRIT WOOD LAKE	227
9	3801	LAKE ASHTABULA	204
10	3808	MATEJCEK LAKE	200
11	3815	WHITMAN LAKE	188
12	3807	LAKE LA MOURE	151
13	3805	DEVILS LAKE	138
14	3804	LAKE DARLING	137

APPENDIX B

CONVERSION FACTORS

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

APPENDIX C

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/11/07

380501
48 01 52.0 098 54 57.0
DEVILS LAKE
38071 NORTH DAKOTA

11EPALES
3

2111202
0018 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/04/29	14	10 0000	4.3		90	2530	8.60	288	0.090	1.800	0.360	0.355
	14	10 0005	4.3	9.0		3090	8.60	368	0.080	2.400	0.400	0.470
	14	10 0014	4.3	7.6		4180	8.55	420	0.110	3.100	0.590	0.672
74/07/16	11	10 0000	23.3	6.6	72	5036	8.60	380	0.070	2.500	0.070	0.474
	11	10 0005	23.3	6.4		5034	8.80	380	0.070	3.000	0.060	0.477
	11	10 0018	22.4	6.2		4986	8.80	402	0.080	2.400	0.070	0.469
74/09/16	15	35 0000	14.9	12.6	12	3793	9.07	520	0.050	5.100	0.020	0.323
	15	35 0007	13.7	9.6		3697	8.91	510	0.040	3.000	0.020K	0.326
	15	35 0015	13.5	9.0		3681	8.97	500	0.060	2.800	0.030	0.340
	15	35 0019	13.5	8.4		3685	9.05	465	0.040	2.800	0.020K	0.317

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/04/29	14	10 0000	0.434	5.7	
	14	10 0005	0.578		
	14	10 0014	0.755		
74/07/16	11	10 0000	0.652	2.7	
	11	10 0005	0.666		
	11	10 0010			1.0
	11	10 0018	0.546		
74/09/16	15	35 0000	0.770	89.4	
	15	35 0007	0.463		
	15	35 0015	0.470		
	15	35 0019	0.432		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/11/07

380502
48 03 38.0 098 56 47.0
DEVILS LAKE
38071 NORTH DAKOTA

11EPALES 2111202
3 0017 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/04/29	14 30	0000	4.0		66	4294	8.50	445	0.180	3.300	0.550	0.784
	14 30	0005	3.7	5.2		4308	8.50	460	0.150	3.300	0.620	0.765
	14 30	0013	2.8	0.4		4400	8.45	530	0.320	3.600	0.480	0.875
74/07/16	10 30	0000	23.5	6.6	72	4873	8.90	398	0.060	2.400	0.060	0.474
	10 30	0005	23.5	6.4		4871	8.90	390	0.070	2.200	0.070	0.471
	10 30	0016	23.4	6.2		5040	8.90	400	0.070	2.300	0.060	0.480
74/09/16	10 55	0000	13.5	8.4	24	3629	8.93	525	0.060	3.300	0.020	0.329
	10 55	0015	13.3	8.0		3616	8.96	550	0.070	2.900	0.020	0.333
	10 55	0019	13.3	8.0		3685	8.95	535	0.080	3.100	0.050	0.323

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/04/29	14 30	0000	0.855	3.9	
	14 30	0005	0.845		
	14 30	0013	0.960		
74/07/16	10 30	0000	0.668	30.5	
	10 30	0005	0.636		
	10 30	0016	0.644		
74/09/16	10 55	0000	0.460	49.0	
	10 55	0015	0.457		
	10 55	0019	0.454		

STORET RETRIEVAL DATE 75/11/07

380503
48 02 13.0 098 58 03.0
DEVILS LAKE
38071 NORTH DAKOTA

11EPALES 2111202
3 0019 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/04/29	16 20	0000	4.6		72	3615	8.60	415	0.090	2.700	0.500	0.584
	16 20	0005	4.5	8.6		3637	8.60	450	0.080	2.700	0.500	0.606
	16 20	0016	3.0	3.2		4440	8.50	610	0.320	3.600	0.430	0.894
74/07/16	10 50	0000	23.1	5.6	84	4961	8.90	445	0.080	2.600	0.030	0.502
	10 50	0005	23.1	5.8		4959	8.90	460	0.090	2.400	0.050	0.568
	10 50	0014	23.1	5.4		4959	8.80	435	0.100	2.400	0.060	0.457
74/09/16	10 30	0000	13.5	9.2	22	3680	8.91	580	0.060	4.400	0.030	0.311
	10 30	0005	13.4			3669	8.89					
	10 30	0015	13.3	9.4		3669	8.94	620	0.050	3.400	0.020K	0.310
	10 30	0020	13.4	9.0		3672	8.96	635	0.060	3.300	0.030	0.311

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/04/29	16 20	0000	0.625	3.6	
	16 20	0005	0.655		
	16 20	0016	0.960		
74/07/16	10 50	0000	0.720	26.5	
	10 50	0005	0.788		
	10 50	0012			1.0
	10 50	0014	0.674		
74/09/16	10 30	0000	0.511	67.3	
	10 30	0015	0.482		
	10 30	0020	0.466		

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/11/07

380504
48 03 31.0 099 01 47.0
DEVILS LAKE
38071 NORTH DAKOTA

11EPALES
3

2111202
0006 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
74/04/29	16 45	0000	7.5		36	2810	8.60	314	0.050	2.500	0.320	0.912
	16 45	0004	7.5	10.8		2801	8.60	324	0.060	2.400	0.330	0.924
74/07/16	10 10	0000	23.7	7.0	36	3115	8.80	314	0.060	3.200	0.060	0.370
	10 10	0006	23.7	7.0		3115	8.80	290	0.050	2.400	0.060	0.333
74/09/16	09 55	0000	12.8	8.0	22	2778	8.83	535	0.110	2.900	0.080	0.195
	09 55	0010	12.8	7.4		2758	8.83	605	0.150	3.500	0.080	0.191

DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L	00031 INCDT LT REMNING PERCENT
74/04/29	16 45	0000	1.560	21.6	
	16 45	0004	1.560		
74/07/16	10 10	0000	0.600	109.0	
	10 10	0006	0.536		1.0
74/09/16	09 55	0000	0.370	52.9	
	09 55	0010	0.360		